



Benchmarking Industrial Plant Energy Efficiency

How EPA's ENERGY STAR® Program Helps Industry Improve Energy Efficiency

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ENERGY STAR



- Voluntary government partnership
 - **Goal: reduce carbon dioxide emissions**
 - Introduced by EPA in 1992 to enable companies to improve in energy efficiency
- The national symbol of energy efficiency and environmental protection
 - Awareness exceeds 70% of U.S. households
 - A brand owned and managed solely by the government
- Focused on improving energy efficiency of:
 - Products
 - Homes
 - **Plants & buildings**
- For industrial businesses, EPA helps manufacturers improve strategic energy management.



ENERGY STAR & Industry



- EPA's goals:
 - ***“Shift the curve” of energy performance for manufacturing industries***
 - Identify the transformative practices to achieve top energy performance
 - Help companies succeed in achieving top performance

ENERGY STAR designed to address the barriers



Barrier

- Lack of a bearing on efficiency



Solution

- Benchmarking is an objective measurement method



ENERGY STAR provides business a clear pathway to succeed



1. Evaluate risks, prepare energy strategy with senior management
2. Build company-wide energy program, using ENERGY STAR
3. Look to suppliers and customers

Let's get on the same page



- Benchmarking
 - The process of comparing to something similar or the best
- ***Energy*** benchmarking
 - The process of comparing the energy performance of facilities, processes or equipment to something similar or the best

Types of benchmarking

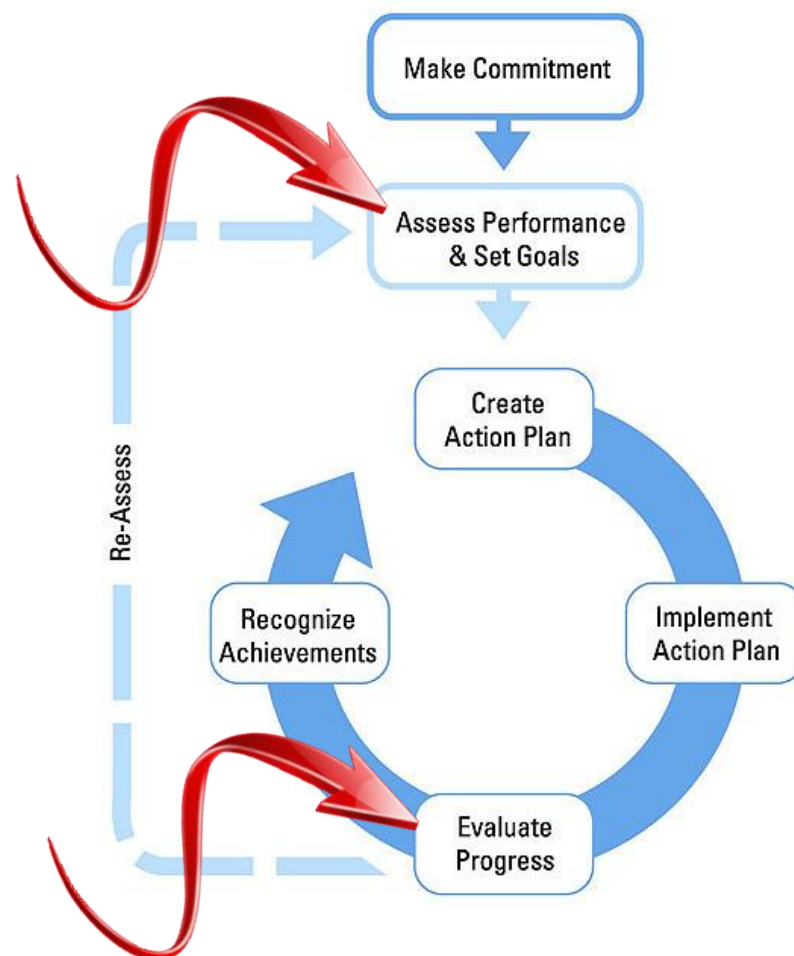
- **Internal**
 - compares performance against internal baseline or benchmark
- **External**
 - compares performance against a metric “outside” of the organization
 - identifies “Best in Class” performance
- **Quantitative**
 - data-driven; compares actual numbers
- **Qualitative**
 - based on best practices; compares actions

Benchmarking's place in energy management



- Fundamental practice
- Energy reductions and project measurement are nice but only benchmarking proves improvements have had an effect
- Can be based on comparison of management practices or energy data
 - **practice** benchmarking gives an idea of where to improve by identifying best energy management practices
 - **energy data** benchmarking informs how well an entity might perform and improve and the position of that entity in terms of energy performance

ENERGY STAR Guidelines for Energy Management



Variety of benchmarking in energy management



Energy Management Objective	Scope		
	Scale	Focus	Time Frame
Assess equipment efficiency	Equipment or process	<u>Internal</u> – comparison against other owned equipment or process <u>External</u> – comparison to industry standard or cooperative study with other organizations	<ul style="list-style-type: none"> •Peak demand period •Three month sample •Weekly •Monthly •Annual •Continuous from baseline
Assess facility performance	Whole facility or sub-metered portion	<u>Internal</u> – comparison of single facility over time. Comparison of similar facilities within single organization <u>External</u> – comparison of facility against national performance rating	<ul style="list-style-type: none"> •Continuous from baseline •Monthly •Quarterly •Annual
Assess department or divisional energy use	Facilities or sub-metered portions of facilities	<u>Internal</u> – comparison against internal sub-divisions	<ul style="list-style-type: none"> •Continuous from baseline •Weekly •Monthly •Quarterly •Annual
Assess organizational performance	All facilities	<u>Internal</u> – comparison over time or towards goal. <u>External</u> – Comparison of portfolio average against a national performance rating	<ul style="list-style-type: none"> •Continuous from baseline •Monthly •Quarterly •Annual

ENERGY STAR benchmarks



- External
- Define “best in class” for an industry or building type
- Industry sector-specific at 6 digit NAICS code (or more refined)
- Energy data at the whole facility level
- Source energy intensity
- Normalized for key variables

ENERGY STAR Industrial Focuses

*Developing specific industrial
plant benchmarks*

ENERGY STAR's industrial sector-specific focuses



Collaborative process to develop:

- ✓ **Energy Performance Indicator (EPI) to benchmark/rate plant energy performance**
- ✓ Energy Guide

Facilitates:

- ✓ Sharing of best practices
- ✓ Networking
- ✓ Development of stronger company energy programs

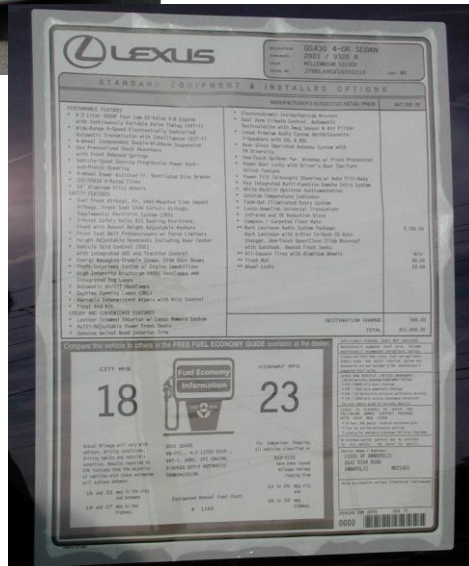
Results in:

- ✓ **Sophisticated plant benchmarking tool**
- ✓ Recognition for energy-efficient plants with the ENERGY STAR
- ✓ Increased momentum for continued improvement
- ✓ Improved efficiency within an industry sector
- ✓ Prevention of carbon emissions

Benchmarking plant energy use: Facility energy performance ratings



**Fuel
Efficiency:
MPG**



**Energy
Efficiency:
1 - 100**

STATEMENT OF ENERGY PERFORMANCE
Building Name Here • 2-11-1999

BUILDING OWNER
Name: John Doe
City: St. Joseph
Contact Name: John Doe
Phone: 123-4567

BUILDING SPACE USE SUMMARY
OFFICE: 10,000 sq ft
DATA CENTER: 5,000 sq ft
GARAGE: 2,000 sq ft

UTILITY BILL SUMMARY
Year: 1998
Electricity (kWh): 100,000
Natural Gas (kWh): 50,000
Oil (kWh): 10,000
Steam (kWh): 5,000
Other (kWh): 1,000
Total Utilities (kWh): 166,000

ENERGY STAR BENCHMARKING ASSESSMENT

This building qualifies for the ENERGY STAR Label for Buildings.

NORMALIZED BENCHMARK DATA

ENERGY STAR	YOUR BUILDING	PROFESSIONAL VERIFICATION
100	75	75

ENERGY COST: \$1.00 per kWh

INDOOR ENVIRONMENTAL CRITERIA
INDOOR AIR POLLUTANTS CONCENTRATIONS:
AEROSOL PARTICULATE (PM10) (µg/m³): 100
THERMAL CONDITIONS (ASHRAE 55): 100
AQUATIC LIFE (FISH) (µg/m³): 100

Benchmarking drives performance

Answers: “If all plants in the industry use energy as this one, what percent of plants in the country would be better, and what percent would be worse?”



Standardized measurement: the plant EPI



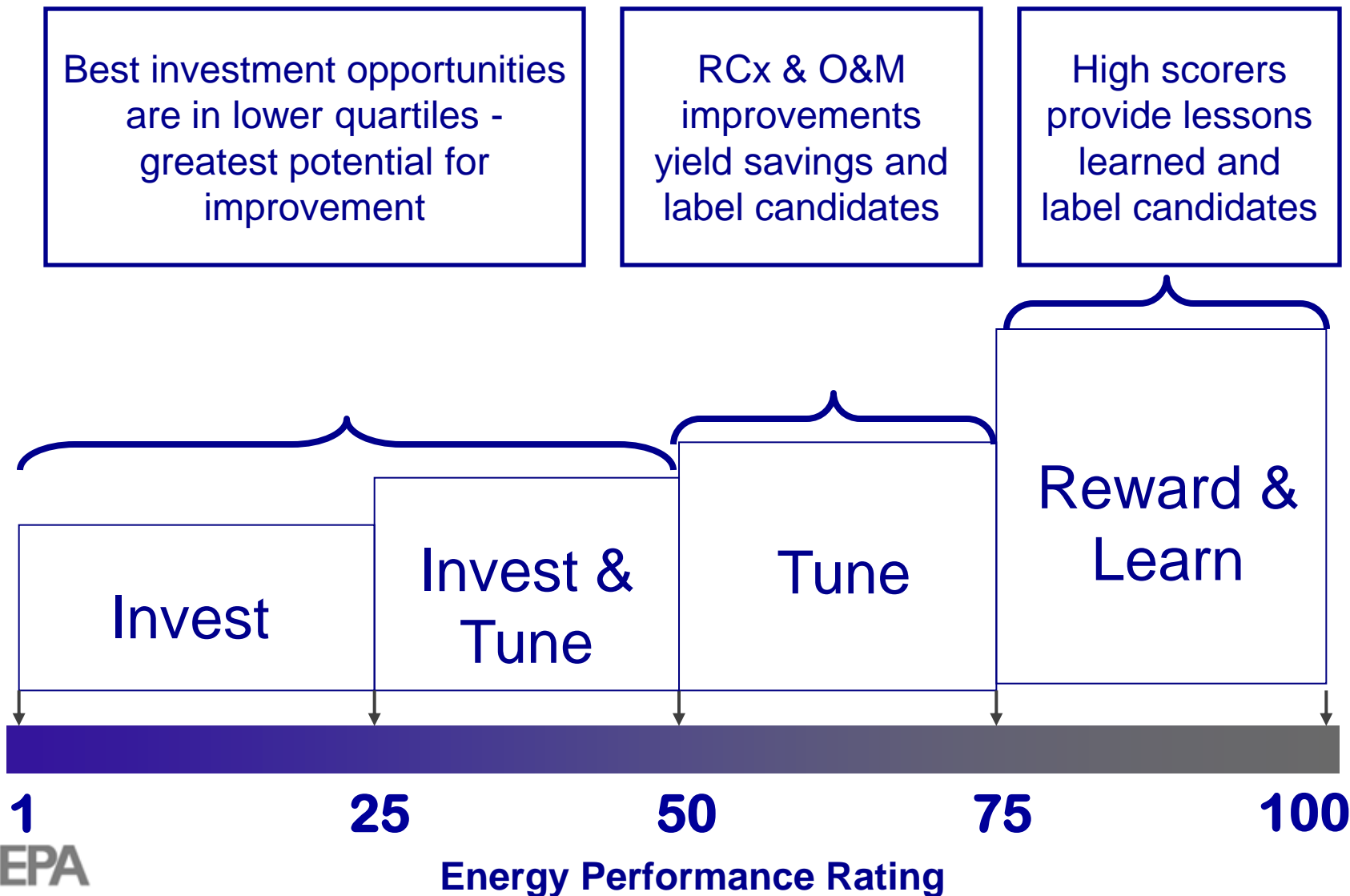
- Plant energy performance indicators (EPI)
 - Enable a higher level of energy management
 - Compare how efficiently a plant uses energy relative to those of its industry
 - Enable goal setting
 - Empower management to require greater energy performance from plants
 - Score plants on a **percentile basis (0-100)**, normalized to a plant's unique configuration
 - ENERGY STAR defines score of 75 or above to be energy-efficient; 50 is average
 - www.energystar.gov/epis
 - www.energystar.gov/industrybenchmarkingtools

What EPA's national level plant energy benchmarking accomplishes



- Empowers industry to **shift the curve of energy performance**
 - For most companies, the ENERGY STAR EPI is the first time they are able to see how their plants' energy performance compares to that of their industry
- Enables companies in the benchmarked industry to **set competitive goals** for plant improvement
- Enables **EPA to gauge improvement** of an industry's energy performance over time

Enabling companies to make informed energy investment decisions

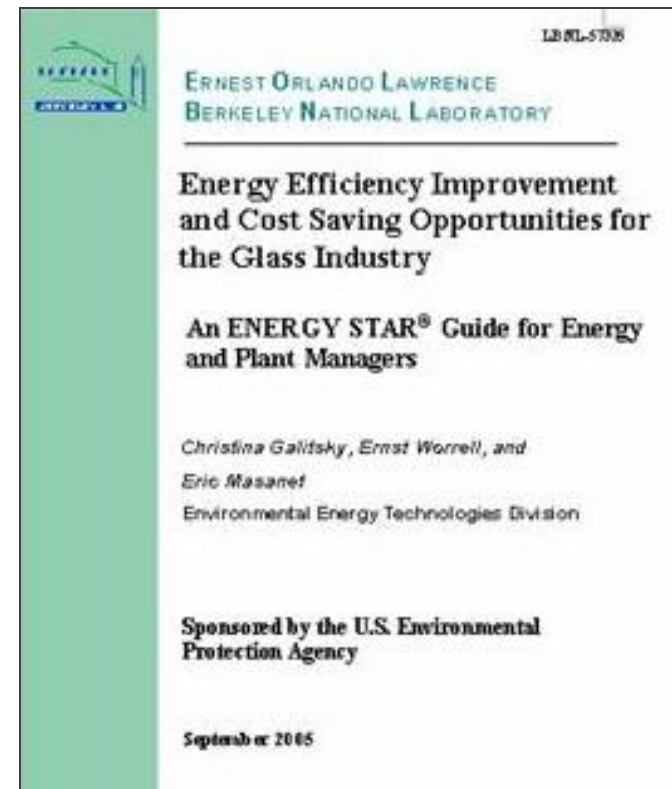


More help to improve: Energy Guides



Practices and technologies available now to improve energy efficiency in an industry

- **Identify existing & promising emerging technologies**
 - provide brief overview of technology or practice
 - review its limitations
 - quantify potential energy and cost savings
 - estimate payback periods
 - provide case study from application
 - highlight industry success stories



Case study



- Example: U.S. cement plant
- Initial cement plant ENERGY STAR EPI score: **61**
- Upgraded in 2002, EPI verified energy reductions of 40%
 - Energy efficiency improved by 2.5 mmBtu/short ton of clinker
- Commercially available technologies employed (described in Energy Guide) :
 - Improved grinding mills
 - Roller mills
 - Improved preheaters
 - Indirect firing
- New ENERGY STAR EPI score: **98**
 - national energy efficiency scoring system demonstrated this plant is now one of the most efficient cement plants in the U.S.

Results – EPA experience with US auto assembly plants



- Based on ENERGY STAR benchmarking of auto assembly plants, EPA has seen fuel usage in the industry improve by 12 percent over a five year period.
- The level of inefficiency has also dropped by 1.0 mmBtu/vehicle.
- The range of performance has also narrowed.
 - This means that while the best auto assembly plants have improved, the others have more than "kept up" with this improvement.

ENERGY STAR benchmarking resources

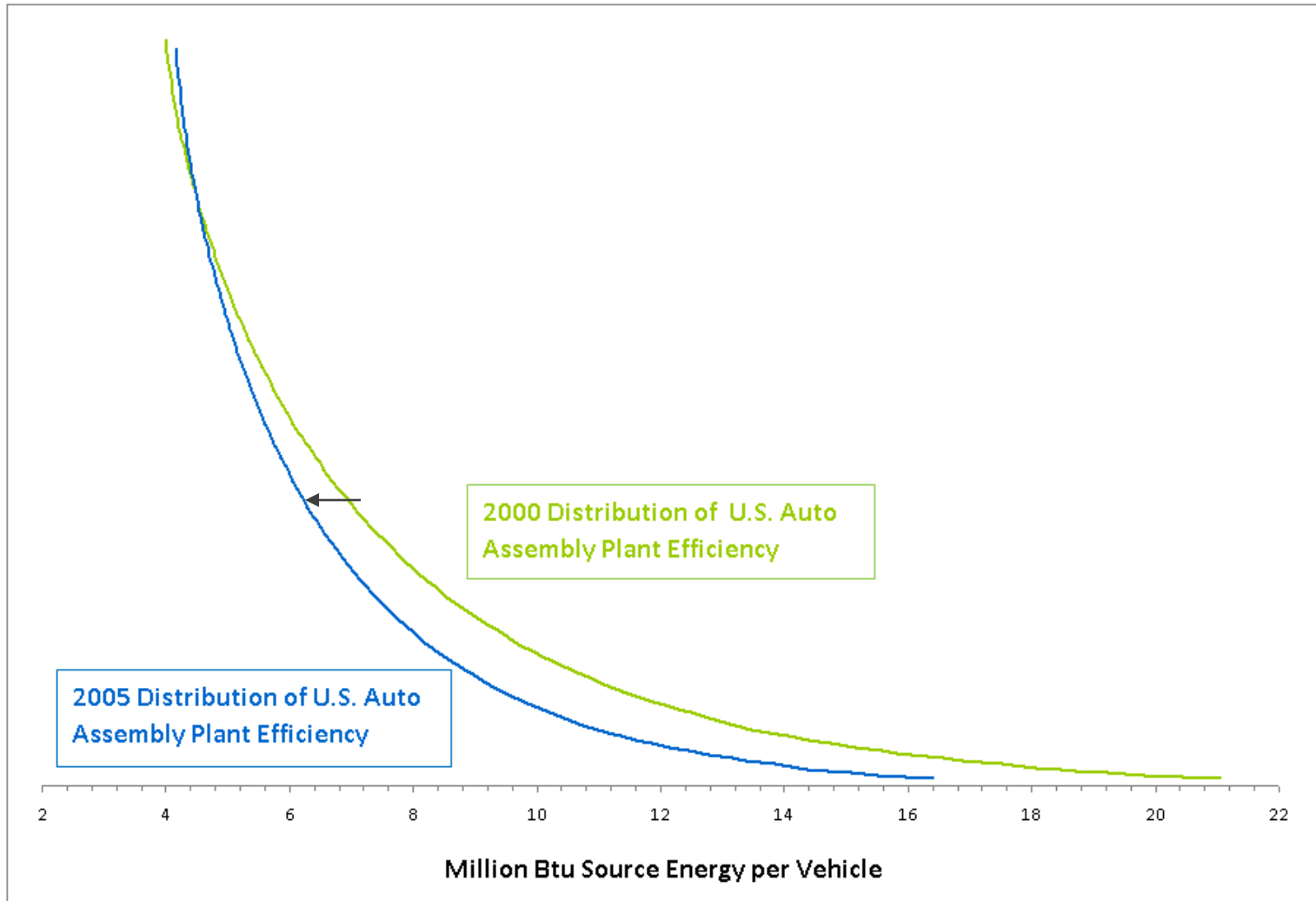


- **Plants** use ENERGY STAR's **Energy Performance Indicators (EPIs)**
- **Commercial Buildings** use ENERGY STAR's **Portfolio Manager**

Industrial EPIs
Motor Vehicle Assembly
Wet Corn Milling
Cement Manufacturing
Petroleum Refining (private system recognized)
Pharmaceuticals
Food Processing (variety)
Glass Manufacturing (variety)
Petrochemicals (draft)
Pulp and Paper
Steel

Portfolio Manager
Office Buildings
Hospitals
K-12 Schools
Hotels
Supermarkets
Retail Stores
Warehouses
Bank Branches
Residence Halls
Waste Water Treatment
Court houses
Medical Office Buildings

ENERGY STAR Benchmarking: Auto Assembly 2000-2005



Lessons



- It is possible to benchmark plants and help industry improve
- Benchmarking takes data (lots of it) and time
- Benchmarked entity should be homogeneous.

Contact



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All resources found at:
www.energystar.gov/industry